COURSE TITLE: Foundations of Energy

UNIT TITLE: Renewable Energy--Wind

SECTION 1: General Information and Overview

Grade Level: 9-12

Suggested Number of Lessons: 12

Suggested Time to Complete Unit: 20-24 class periods

Unit Overview: This unit will focus on defining wind energy, where it originates and what we can do with it. Students will also explore how we have used wind energy in the past, how we use it now and how it may be used in the future.

SECTION 2: Essential Questions

1.	What is wind energy and what are the differences between onshore and offshore wind?
2.	What role does wind energy play in our lives personally, locally, nationally and globally?
3.	What is the value of wind energy in our energy portfolio and our economy?

SECTION 3: Major Focus

Technical Content CTE Program of Studies	Learner Activities (Enabling Knowledge and Skills/Processes)	Core Content For Assessment	Academic Expectations
Construction Technology KOSSA Standard AD-002: Demonstrate the ability to learn new processes and steps. **2.1--**Assess the impact of various current and new technologies on the economy. **2.18--**Analyze how supply and demand impacts Kentucky's economy in relation to energy.	**Using** the resource *CD* and PDF files in the *Wind unit*, **research:** - current and new policies in the wind energy industry - current energy trends -impact on our nation's energy portfolio and economy at the state and national level. **Watch** a variety of videos about wind turbines. **Identify** key components in the supply chain for wind turbines.	**SC-HS-4.6.2** Students will: • predict wave behavior and energy transfer; • apply knowledge of waves to real life phenomena/investigations. Waves, including sound and seismic waves, waves on water and electromagnetic waves, can transfer energy when they interact with matter. Apparent changes in frequency can provide information about relative motion. **DOK 3**	**2.1** Students understand scientific ways of thinking and working and use those methods to solve real-life problems.

Construction Technology KOSSA Standard AD-003: Implement new processes given oral instructions. **2.1-2.3--**Engaging in meaningful hands-on, minds-on conceptual based activities in the area of energy technologies.	Using the resource files on the *Foundations of Energy CD,* **develop** a presentation on the new and emerging wind technologies. That information will be assessed in the activity *Energy Source Expo*.	**SC-HS-4.6.6** Students will understand that heat is the manifestation of the random motion and vibrations of atoms.	**2.2** Students identify, analyze and use patterns such as cycles and trends to understand past and present events and predict possible future events.
1.10-5.4--Demonstrate knowledge and skills in blueprint reading in energy technologies.	Using the *Wind activities from Hands-on Kit* and the wind activities, students will **explore** wind energy in the US and around the world, **-review** perspectives and laws for siting a wind farm. **Interpret** findings. **Compare** findings with classmates and agree on the availability of wind in Kentucky. **Analyze** and **compare** 50m to 80m wind maps and **identify** regions of the state for potential wind production.	**SC-HS-4.6.9** Students will: • explain the cause and effect relationship between global climate and weather patterns and energy transfer (cloud cover, location of mountain ranges, oceans); • predict the consequences of changes to the global climate and weather patterns. Global climate is determined by energy transfer from the sun at and near earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation and static conditions such as the position of mountain ranges and oceans. **DOK 3**	
	Conduct research using resource texts, websites, brochures, booklets and the *Secondary Info-book* http://www.need.org/Energy-Infobooks to **identify** and **define** key wind terms: • lift • drag • Betz limit	**MA-HS-1.2.1** Students will estimate solutions to problems with real numbers (including very large and very small quantities) in both real-world and mathematical problems, and use the estimations to check for reasonable computational results.	

		MA-HS-2.2.1 Students will continue to apply to both real-world and mathematical problems U.S. customary and metric systems of measurement.	
Construction Technology KOSSA Standard EA-009: Students will show an understanding of established guidelines for safety in Energy	Using resource CD, wind kit and videos in the file, - **explore** wind energy around the world, -**develop** a "wind for schools team" -**analyze** wind opportunities at the school location -**review** perspectives, laws and **investigate** and **interpret** findings for possible wind turbine location. -**share** proposal with school officials.	**MA-HS-2.2.1** Students will continue to apply to both real-world and mathematical problems U.S. customary and metric systems of measurement.	

SECTION 4: Culminating Project with Scoring Guide

Students will team and work in groups of four to build bench top turbines. Using the blade design challenge, compete against other teams in the class for the best voltage production. Design the best turbine blades using the design challenge PDF files in the student guide.

SCORING GUIDE:

CATEGORY	4	3	2	1
CONTENT	EXTENSIVE- CONTENT BEYOND WHAT IS TAUGHT IN CLASS	GOOD- EXPLANANTION OF CONCEPTS COVERED IN CLASS	BASIC – WHAT HAS ALREADY BEEN COVERED IN CLASS	LIMITED- DOESN'T COVER MATERIAL AS WELL AS DONE IN CLASS
TECHNOLOGY	EXTENSIVE- POWER POINT WITH EXCELLENT ANIMATION AND PICTURES	APPROPRIATE- POWER POINT HAS SOME ANIMATION AND PICTURES	BASIC- POWER POINT WITH LITTLE ANIMATION AND PICTURES	LIMITED – POWER POINT WITH NO ANIMATION OR PICTURES
PRESENTATION	EXCELLENT- FLOWS WELL, AUDIENCE VERY ATTENTIVE- WELL REHEARSED	GOOD – FLOWS WELL PARTICIPANTS KNOW MATERIAL WELL	BASIC – FLOWS UNEVENLY MAY HAVE SOME READING OF NOTES OR SLIDES	LIMITED- PARTICIPANTS READ FROM NOTES OR SLIDES
INTEREST	EXTENSIVE – PARTICIPANTS MAKE MANY EXTENSIONS AND EXPLANATIONS	APPROPRIATE – ENCOURAGES QUESTIONS AND COMMENTS	BASIC – CAN FIELD SOME QUESTIONS	LIMITED – GLAD TO BE THROUGH WITH THE PRESENTATION

SECTION 5: Assessment and Enabling Skills and Processes

Assessment:	Participation in building bench top wind turbine and a blade design challenge in teams of four. Each student in the team will take on a lead role in the project accompanied by a team power point presentation of 10 slides and present to the class and school officials. Summarize findings of the siting project and present to school officials.

SECTION 6: Support Materials (i.e., Resources, Technology, and Equipment)

A. Resources	NEED Secondary Energy Info Book, Secondary Wind Guide, Wind Kit
B. Technology	Computer
C. Websites (samples of many available)	American Wind Energy Association, www.awea.org, Kid Wind, www.learn.kidwind.org; National Energy Education Development, www.need.org
D. Equipment	Wind Kit from NEED, tools for building the project